Wildfires Lead to More Warming Than Climate Models Predict, a New Mexico Fire Study Reports

Research Highlight

Analyzing fresh, carbon-rich aerosols in smoke from the largest wildfire in New Mexico (2011), scientists report large impacts of wildfires on climate.

A research study, published last week in *Nature Communications*, has revealed that smoke from wildfires, or biomass-burning events, contains large quantities of carbon-rich particles and organic substances that may lead to significant warming of the Earth's climate. The finding challenges long-held views of the climate community that wildfires have little to no impact on the Earth's climate.

Current climate models assume that the two most conspicuous products of biomass burning events—soot and smoke—impact climate in opposite ways. Soot particles, rich in pure carbon, are produced when a fire's temperature is high but the supply of oxygen is low. These particles strongly absorb sunlight and thereby warm the Earth's climate. Smoke, on the other hand, contains carbon, along with other chemicals, and is produced when a fire's temperature is relatively low and the supply of oxygen is high. Models assume that smoke reflects sunlight and therefore cools surface temperatures. Using high-precision instruments, a research team from Michigan Technological University and Los Alamos National Laboratory analyzed aerosol samples that they collected over ten days from a smoldering fire at La Conchas, New Mexico. The fire started on June 26, 2011, and was the largest in the history of New Mexico, burning 245 square miles and causing widespread evacuation of parts of the state.

The team found that smoke from the La Conchas fire contained large quantities—ten times more than previously thought—of a special type of carbon-rich aerosol. Known as "tar balls," these aerosols are spherical in shape (as the name suggests) and strongly absorb sunlight, warming the Earth's atmosphere.

The team also found that organic substances in the smoke almost always coat the soot particles; 50% of the soot particles are coated completely by the organic substances present in the smoke. The coatings act as lenses that focus and amplify the amount of sunlight the soot particles absorb. The tar balls and coated soot particles in the smoke do not cancel out each other's effect as climate models assume, but together more than double the amount of warming at the surface.

Paucity of data so far has resulted in an incomplete, perhaps even inaccurate understanding of the impact of wildfires on climate. This study demonstrates that proper understanding of the properties of aerosols are critical in evaluating the impact of wildfires on climate, especially as dry and hot summers lead to an increase in the frequency of these events.

La Conchas fire, New Mexico

Reference(s)

China S, C Mazzoleni, K Gorkowski, AC Aiken, and MK Dubey. 2013. "Morphology and mixing state of individual freshly emitted wildfire carbonaceous particles." Nature Communications, 4, 2122, doi:10.1038/ncomms3122.

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Aerosol Life Cycle